Q2 Room temperature = 72°

day 75

t	0	5	10
y(t)	450	388	338

Let P be the temperature of the pie.

$\frac{dP}{dt} = k(P-72)$ differential equation

Answer: a function

Special kind of differential equation

"P" called a SEPARABLE diff. eq. "t"

$\frac{dP}{dt} = k(P-72)$

$\frac{dP}{P-72} = \frac{k(P-72)}{P-72}\,dt$

$f(x) = g(x)$ $\int f(x)\,dx = \int g(x)\,dx$

$\int \frac{1}{P-72}\,dP = \int k\,dt$

Let $u = P-72$

$du = dP$

$\int \frac{1}{u}\,du$

$\ln|u| + C$

$\ln|P-72| + C = kt$

$e^{(\ln|P-72| = (kt+C)}$

e

backwards rule $a^m \cdot a^n = a^{m+n}$

$|P-72| = e^{kt} e^{C}$ = ? wave hands

$P-72 = Ce^{kt}$

$P = Ce^{kt} + 72$

figure out specifics

$P(0) = 450°$

$P(0) = Ce^{k(0)} + 72$

$= C(1) + 72 = 450°$

$\Rightarrow C = 450 - 72 = 378$

$P(t) = 378e^{kt} + 72$

another specific

$P(5) = 388$

$P(5) = 388 = 378e^{5k} + 72$

$316 = 378e^{5k}$

$\frac{316}{378} = e^{5k}$

$\ln\left(\frac{316}{378}\right) = 5k$

$\frac{1}{5}\ln\left(\frac{316}{378}\right) = k$

$P(t) = 378e^{t\ln\left(\frac{316}{378}\right)} + 72$

Newton's Law of Cooling

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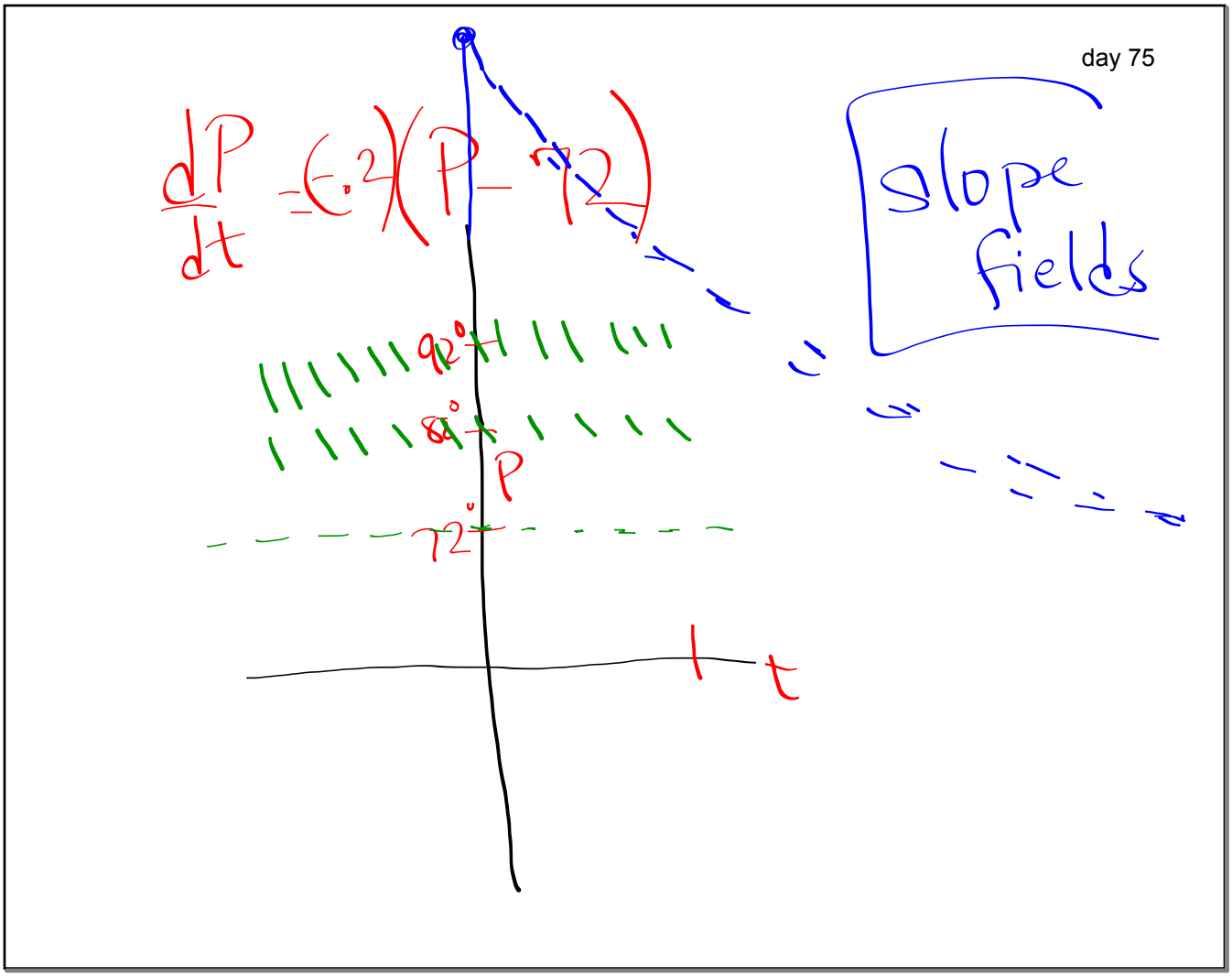
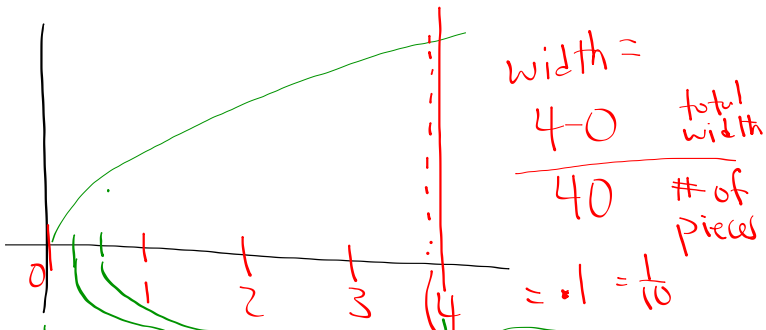

day 75
$\frac{dP}{dt} = -(.2)(P - 72)$
slope fields
92°
82°
P
72°
t

day 75

43) $f(x)=\sqrt{x}$; $[0,4]$, $n=40$



width = $\frac{4-0}{40} = .1 = \frac{1}{10}$ (total width / # of pieces)

$0+0\left(\frac{1}{10}\right)$ $0+1\left(\frac{1}{10}\right)$ $0+2\left(\frac{1}{10}\right)\cdots$ $0+39\left(\frac{1}{10}\right)$ $0+40\left(\frac{1}{10}\right)$

starting x value

width of each subinterval

how many subintervals I count over

Process

problem $\Rightarrow$ Sigma (Σ) notation $\Rightarrow$ calculator

add up areas of rectangles – LHS or RHS or something

left endpoint

$$\text{Sum} = \underbrace{\frac{1}{10}}_{\text{width}}\left(\sqrt{\underbrace{0+0\left(\frac{1}{10}\right)}_{\text{height}}}\right)+\frac{1}{10}\left(\sqrt{0+1\left(\frac{1}{10}\right)}\right)+\cdots+\frac{1}{10}\left(\sqrt{0+39\left(\frac{1}{10}\right)}\right)$$

$$* \quad \sum_{K=0}^{39}\left(\frac{1}{10}\right)\left(\sqrt{0+K\left(\frac{1}{10}\right)}\right) \approx \frac{1}{10}\sum_{K=0}^{39}\sqrt{\frac{K}{10}}$$

sum(seq($\sqrt{X/10}$, X, 0, 39, 1))

ALSO: $\frac{1}{10}\sum_{K=1}^{40}\sqrt{\frac{(K-1)}{10}}$

Jan 2-7:06 AM

day 75

5.2/67